



## TEST REPORT

Test of: Tempus IC

To: OET Bulletin 65 Supplement C: (2001-01)  
IEEE1528: 2003

FCC ID: ROSTEMPUSIC-2

Test Report Serial No:  
UL-SAR-RP92460JD01A V1.0

This Test Report Is Issued Under The Authority  
Of Richelieu Quoi, SAR Technology Consultant:

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**1. Customer Information**

<b>Company Name:</b>	Remote Diagnostic Technologies Ltd
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<b>Address:</b>	The Old Coach House The Avenue Farleigh Wallop Hampshire RG25 2HT United Kingdom
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## 2. Summary of Test Results

Test Name	Specification Reference	Result
Specific Absorption Rate - GSM 850	OET Bulletin 65 Supplement C: (2001-01)	
Specific Absorption Rate - PCS 1900	OET Bulletin 65 Supplement C: (2001-01)	

### Key to Results



= Complied



= Did not comply

### 2.1. Highest Reported SAR

#### Individual Transmitter Evaluation per Band:

Exposure Configuration	Technology Band	Highest Reported 1g -SAR (W/kg)	Equipment Class	Max Rated Source base Avg Power + Max Tolerance [dBm]	Highest Reported 1g-SAR (W/kg)
Lap Held (Separation Distance 0mm)	GSM850	0.021	PCE	27.0	0.020
	PCS1900	0.010		24.5	

**2.2. Highest Reported SAR (Continued):**

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna.

**Simultaneous Transmitter Evaluation:**

Exposure Configuration	Technology Band	Highest Reported 1g SAR (W/kg)	Equipment Class	Max Rated Source base Avg Power + Max Tolerance [dBm]	Highest Reported Sum-SAR 1g-SAR (W/kg)	SPLSR Ratio
Lap Held (Separation Distance 0mm)	GSM850	0.021	PCE	27.00	0.096	N/A
	Bluetooth	0.075 <sup>1</sup>	DSS	13.20		
	WLAN 2.4 GHz	0.053 <sup>1</sup>	DTS	11.89	0.128	N/A
	Bluetooth	0.075 <sup>1</sup>	DSS	13.20		

**Note(s):**

1. Estimated SAR: calculated using the following formula as per FCC KDB publication 447498:

*(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] [√f<sub>(GHz)</sub>/x] W/kg for test separation distances ≤ 50 mm;*

*where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.*

2. As per FCC KDB 447498 D01, the individual test positions of each exposure conditions were considered separately for the sum of 1g Simultaneous transmission. The Sum of SAR for WWAN+ WPAN and WPAN + WLAN < 1.6 w/kg.

**2.3. SAR measurement variability and measurement uncertainty analysis:****Note(s):**

The condition for SAR variability was met as the SAR level measured and calculated was below the specified threshold as per KDB publication 865664 D01, section 2.8.1

**2.4. Location of Tests**

All the measurements described in this report were performed at the premises of UL, Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG United Kingdom

**2.5.Nominal and Maximum Output power:  
WWAN****Measured Average Power without consideration for Uplink time slots:**

Bands	GPRS			
	Tx Slot 1		Tx Slot 2	
	Target (dBm)	Tolerance $\pm$ (dB)	Target (dBm)	Tolerance $\pm$ (dB)
GSM850	32.0	-1.0 ~ + 1.0	32.0	-1.0 ~ + 1.0
PCS1900	29.5	-1.0 ~ + 1.0	29.5	-1.0 ~ + 1.0

**Measured Average Power with consideration for Uplink time slots:**

Bands	GPRS			
	Tx Slot 1		Tx Slot 2	
	Target (dBm)	Tolerance $\pm$ (dB)	Target (dBm)	Tolerance $\pm$ (dB)
GSM850	23.0	-1.0 ~ + 1.0	26.0	-1.0 ~ + 1.0
PCS1900	20.5	-1.0 ~ + 1.0	23.5	-1.0 ~ + 1.0

**Note:**

1. As per KDB865664 D02 SAR Reporting v01, 2.1.4(a), the nominal and maximum average source based rated power, declared by manufacturer are shown in the above tables.
2. These are specified maximum allowed average power for all the wireless modes and frequency bands supported.

**WLAN and WPAN**

Band	Max Power {Target (dBm) + Upper Tolerance (dB)}
WiFi 802.11b/g	11.89

Band	Max Power {Target (dBm) + Upper Tolerance (dB)}
Bluetooth	13.2

**Note:**

1. As per KDB865664 D02 SAR Reporting v01, 2.1.4(a), the nominal and maximum peak rated power, declared by manufacturer are shown in the above tables.
2. These are specified maximum allowed peak (or average) power for all the wireless modes and frequency bands supported.

### 3. Test Specification, Methods and Procedures

#### 3.1. Test Specification

<b>Reference:</b>	OET Bulletin 65 Supplement C: (2001-01)
<b>Title:</b>	Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
<b>Purpose of Test:</b>	To determine whether the equipment met the basic restrictions as defined in OET Bulletin 65 Supplement C: (2001-01) using the SAR averaging method as described in the test specification above.

The Equipment Under Test complied with the Specific Absorption Rate for general population/uncontrolled exposure limit of 1.6 W/kg as specified in FCC 47 CFR part 2 (2.1093) and ANSI C95.1-1992 and has been tested in accordance with the reference documents in section 3.2 of this report.

#### 3.2. Methods and Procedures Reference Documentation

The methods and procedures used were as detailed in:

Federal Communications Commission, "Evaluating compliance with FCC Guidelines for human exposure to radio frequency electromagnetic fields", OET Bulletin 65 Supplement C, FCC, Washington, D.C, 20554, 2001.

Thomas Schmid, Oliver Egger and Neils Kuster, "Automated E-field scanning system for dosimetric assessments", IEEE Transaction on microwave theory and techniques, Vol. 44, pp. 105-113, January 1996.

Neils Kuster, Ralph Kastle and Thomas Schmid, "Dosimetric evaluation of mobile communications equipment with know precision", IEICE Transactions of communications, Vol. E80-B, No.5, pp. 645-652, May 1997.

IEEE 1528: 2003

IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques

#### FCC KDB Publication:

KDB 248227 D01 "SAR measurements for 802.11a/b/g v01r02"

KDB 447498 D01 General RF Exposure Guidance v05

KDB 941225 D03 " SAR Test Reduction GSM/GPRS/EDGE v01"

KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01

KDB 865664 D02 SAR Reporting v01

#### 3.3. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the methods & procedures section above. Appendix 1 contains a list of the test equipment used.



#### 4. Equipment Under Test (EUT)

##### 4.1. Identification of Equipment Under Test (EUT)

Description:	Medical vital signs monitor
Brand Name:	Tempus IC
Model Name or Number:	None Stated
Type Number:	None Stated
Serial Number:	000673
IMEI Number:	353681045991114
FCC ID Number:	ROSTEMPUSIC-2
Country of Manufacture:	United Kingdom
Date of Receipt:	06 March 2013

##### Note(s):

This sample was used to perform WWAN SAR evaluation and conducted power measurements. The sample supports simultaneous transmission with the WWAN and WPAN or WLAN and WPAN.

##### 4.2. Description of EUT

The Equipment Under Test is a 'Medical vital Signs Monitor' with GSM 2G Quad Band and Wi-Fi bands. The EUT has GPRS Class 10, WLAN 802.11 b/g and Bluetooth mode capabilities.

##### 4.3. Modifications Incorporated in the EUT

There were no modifications incorporated in the EUT

**4.4. Accessories**

The following accessories were supplied with the EUT during testing:

<b>Description:</b>	Battery
<b>Brand Name:</b>	Tempus IC
<b>Model Name or Number:</b>	01-1001
<b>Serial Number:</b>	N/A
<b>Cable Length and Type:</b>	Not Applicable
<b>Country of Manufacture:</b>	United Kingdom
<b>Connected to Port</b>	8-pin contact

**4.4.1. Support Equipment**

The following support equipment was used to exercise the EUT during testing:

<b>Description:</b>	Wireless Communication Test Set
<b>Brand Name:</b>	Agilent
<b>Model Name or Number:</b>	8960 Series 10 (E5515C)
<b>Serial Number:</b>	GB46311280
<b>Cable Length and Type:</b>	~4.0m Utiflex Cable
<b>Connected to Port:</b>	RF (Input / Output) Air Link

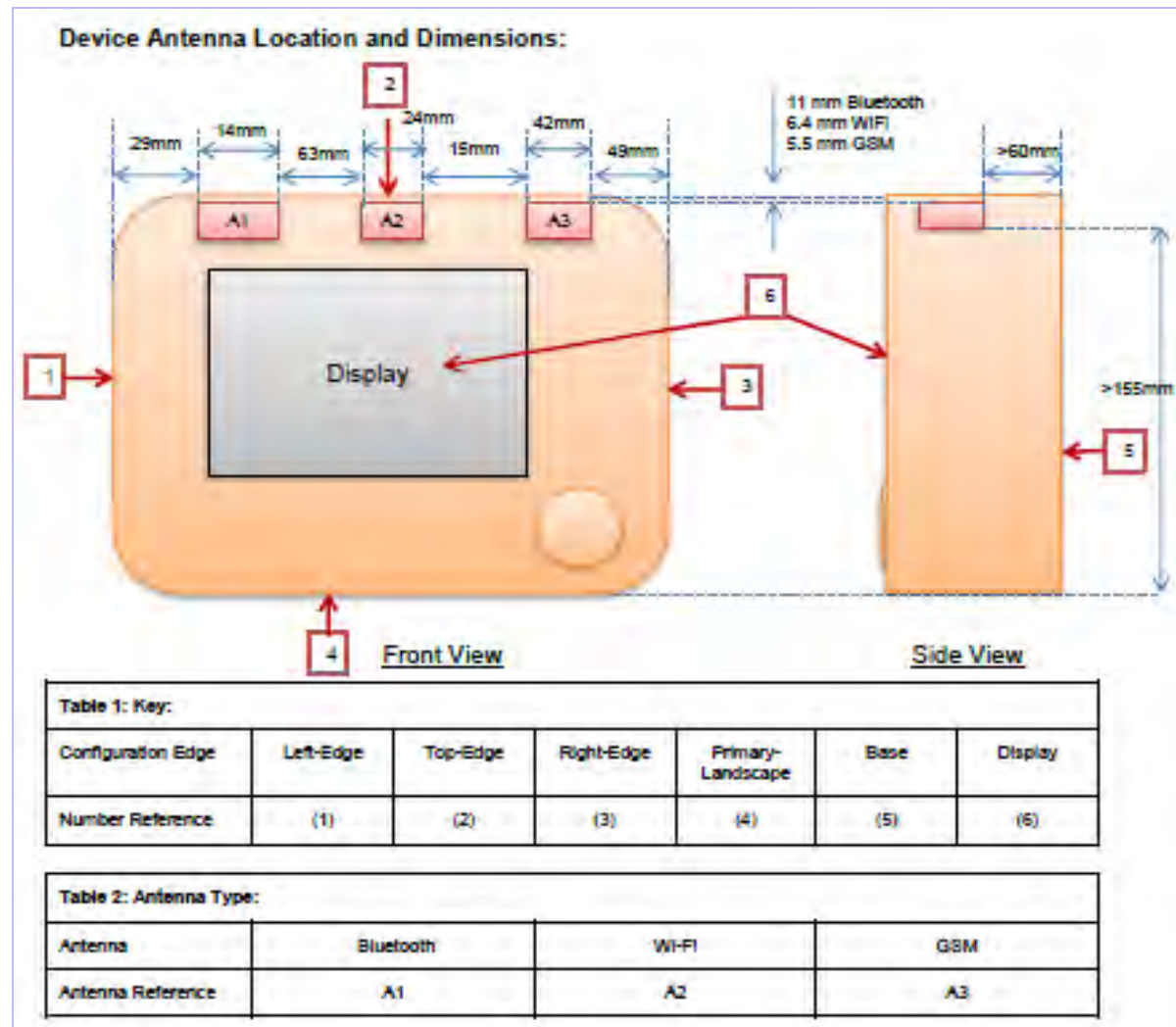
#### 4.5. Additional Information Related to Testing

Equipment Category	GSM/GPRS850, PCS/GPRS1900 WiFi802.11 b/g/n <i>Bluetooth</i>	
Type of Unit	Portable Transceiver	
Intended Operating Environment:	Medical Environment (Within GSM , Wi-Fi and Bluetooth Coverage)	
Transmitter Maximum Output Power Characteristics:	GSM850	Communication Test Set was configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 5.
	PCS1900	Communication Test Set was configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 0.
	WiFi802.11b/g	15.4mW or ~11.89 dBm
	<i>Bluetooth</i>	21.9mW or ~13.20 dBm

**Additional Information Related to Testing (Continued):**

<b>Transmitter Frequency Range:</b>	GSM850		824 to 849 MHz	
	PCS1900		1850 to 1910 MHz	
	WiFi802.11b/g/n		2412 to 2472 MHz	
	<i>Bluetooth</i>		2402 to 2480 MHz	
<b>Transmitter Frequency Allocation of EUT When Under Test:</b>	<b>Band</b>	<b>Channel Number</b>	<b>Channel Description</b>	<b>Frequency (MHz)</b>
	GSM850	128	Low	824.2
		190	Middle	836.6
		251	High	848.8
	PCS1900	512	Low	1850.2
		661	Middle	1880.0
		810	High	1909.8
	2.4 GHz Wi-Fi 802.11b/g	1	Low	2412.0
		6	Middle	2437.0
		13	High	2472.0
	Bluetooth	0	Low	2402.0
		39	Middle	2440.0
		78	High	2480.0
<b>Modulation(s):</b>	GMSK (GPRS): 217 Hz QPSK(UMTS / HSDPA/HSPA):0Hz DBPSK, BPSK, CCK (Wi-Fi): 0 Hz			
<b>Modulation Scheme (Crest Factor):</b>	GMSK (GPRS850/GPRS1900): 4 DBPSK, BPSK, CCK (Wi-Fi): 1 QPSK(UMTS FDD / HSDPA): 1			
<b>Antenna Type:</b>	Internal integral			
<b>Antenna Length:</b>	Unknown			
<b>Number of Antenna Positions:</b>	1 fixed (WWAN) 1 fixed (WLAN) 1 fixed ( <i>Bluetooth</i> )			
<b>Power Supply Requirement:</b>	3.2-4.2V			
<b>Battery Type(s):</b>	Li-ion			

### Additional Information Related to Testing (Continued):



### Simultaneous Transmission SAR Test Consideration:

The device under test support simultaneous transmission and the following combination below are applicable to the device operation, as declared by the manufacturer:

GSM	WiFi	Bluetooth	Simultaneous Transmission
X	X	X	No
X	X		No
X		X	Yes
	X	X	Yes

## 5. Deviations from the Test Specification

Test was performed as per KDB 248227 D01 "SAR measurements for 802.11a/b/g v01r02", KDB 447498 D01 General RF Exposure Guidance v05,, KDB 941225 D03 " SAR Test Reduction GSM/GPRS/EDGE v01", KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01, KDB 865664 D02 SAR Reporting v01 , according to the handset procedures in IEEE Std 1528-2003 and OET Bulletin 65 Supplement C 01-01.

The test procedure was agreed with FCC prior to testing. The following configuration was agreed to be evaluated:

Based on the described usage scenarios and device specification, only lap-held position (bottom side faces a flat phantom at 0mm) is required. The hand-held and body-worn positions are not required. (Please see section 4.5 for the detail illustration)

FCC confirmed in the KDB inquiry, that the for RF exposure considerations, standalone SAR test exclusion in KDB 447498 can be applied for SDIO card and Bluetooth with a test separation distance of 60mm, as shown in the KDB inquiry illustration. It was also allowed to use the highest of the measured, specified or rated peak or average conducted power to do the calculation to qualify for the SAR test exclusion. (Please see section 6.3 for detail calculation)

GPRS class 10 / uplink setup of 1-uplink, 2-uplink were all evaluated to find the setting with the highest power reference point (unit v/m) as per the DASY4 system. 2-uplink was found to give the highest power reference point measurement on the DASY4 system (unit v/m) for GPRS850 and GPRS1900. All settings were performed with the device in a fixed position Front facing phantom at 0mm separation to ensure there were no positioning errors. The following values were measured relative to the uplink settings:

GPRS Mode	GPRS850 Power reference (v/m)	GPRS1900 Power reference (v/m)
1 uplink	1.54	2.56
2 uplink	<b>2.21</b>	<b>3.76</b>

Note: Power reference point measurements are from the DASY4 system and used to check the device power drift although the units are v/m. For informational purpose to ensure the worst case uplink time slot is also verified by the DASY4 SAR system, this was use as per above comment at a fixed point.

## 6. Operation and Configuration of the EUT during Testing

### 6.1. Operating Modes

The EUT was tested in the following operating mode(s) unless otherwise stated:

- GPRS850 – Data allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 5. Tested using 2 Uplink time slots with CS1 for GPRS.
- GPRS1900 – Data allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 0. Tested using 2 Uplink time slots with CS1 for GPRS.

GSM850: Power Table Settings used for Test Set	
Power Control Level PCL	Nominal Power (dBm)
0 ... 2	39
3	37
4	35
<b>5</b>	<b>33</b>
6	31
7	29
8	27
9	25
10	23
11	21
12	19
13	17
14	15
15	13
16	11
17	9
18	7
19 ... 31	5

PCS1900: Power Table Settings used for Test Set	
Power Control Level PCL	Nominal Power (dBm)
22 ... 29	Reserved
30	33
31	32
<b>0</b>	<b>30</b>
1	28
2	26
3	24
4	22
5	20
6	18
7	16
8	14
9	12
10	10
11	8
12	6
13	4
14	2
15	0
16 ... 21	Reserved

## 6.2. Configuration and Peripherals

The EUT was tested in the following configuration(s) unless otherwise stated:

- Standalone fully charged battery powered.
- Lap-held configurations were evaluated.
- GPRS class 10: setup for 1-uplink, 2-uplink was evaluated to find the setting with the highest power reference measurements. 2-uplink was found to give the highest power reference point measurement on the DASY4 system (unit v/m) for GPRS850 and GPRS1900. All settings were performed with the device in a fixed position 'Back facing phantom' at 0mm separation to ensure there were no positioning errors.

### Lap Held Configuration

- a) The EUT was placed in a normal operating position where the centre of EUT was aligned with the centre reference point on the flat section of the 'SAM' phantom.
- b) With the EUT touching the phantom at an imaginary centre line. The EUT was aligned with a marked plane (X and Y axis) consisting of two lines.
- c) For the touch-safe position the EUT was gradually moved towards the flat section of the 'SAM' phantom until any point of the EUT touched the phantom.
- d) For position(s) greater than 0mm separation the EUT was positioned as per the touch-safe position, and then the vertical height was decreased/adjusted as required.
- e) SAR measurements were evaluated at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimise the drift.
- f) The device was keyed to operate continuously in the transmit mode for the duration of the test.
- g) The location of the maximum spatial SAR distribution (hot spot) was determined relative to the EUT and its antenna.
- h) The EUT was transmitting at full power throughout the duration of the test powered by a fully charged battery.



### 6.3. SAR Test Exclusion Consideration

Frequency Band	Configuration(s)
	Lap-held
GSM850	No
PCS1900	No
WLAN 2.4 GHz	Yes
Bluetooth	Yes

**Note:**

- As per KDB 447498 D01 General RF Exposure Guidance v05, The Frequency Bands with Rated Power including Upper tolerance, which qualify for **Standalone SAR Test Exclusion**, are as per the above table.

- The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where}$$

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm is applied to determine SAR test exclusion.

- At 100 MHz to 6 GHz and for test separation distances  $> 50$  mm, the SAR test exclusion threshold is determined according to the following:
  - [Threshold at 50 mm in step 1) + (test separation distance - 50 mm) · (f(MHz)/150)] mW, at 100 MHz to 1500 MHz
  - [Threshold at 50 mm in step 1) + (test separation distance - 50 mm) · 10] mW at  $> 1500$  MHz and  $\leq 6$  GHz

For lap held configuration, the edge closest to the lap is found to be at a distance of 60mm, as a result this is considered as the separation distance for test exclusion calculation,

Applying formula I) for WLAN 2.4GHz band at 50mm we get:

$$\text{➤ For 2.4GHz, } [(15.4)/50] \cdot [\sqrt{2.4}] = 0.477$$

Applying this result in II) a) we get,

$$\text{For 2.4GHz, } [(0.477) + (60-50) \cdot (10)] = 47.7\text{mW} < 196\text{mW (threshold obtained from Appendix B of KDB 447498)}$$

Hence, Standalone SAR for WLAN 2.4GHz does not have to be evaluated.

Applying formula I) for Bluetooth 2.4GHz band at 50mm we get:

$$\text{➤ For 2.4GHz, } [(21.9)/50] \cdot [\sqrt{2.4}] = 0.678$$

Applying this result in II) a) we get,

$$\text{For 2.4GHz, } [(0.678) + (60-50) \cdot (10)] = 67.8\text{mW} < 196\text{mW (threshold obtained from Appendix B of KDB 447498)}$$

Hence, Standalone SAR for Bluetooth does not have to be evaluated

- The details for the **Maximum Rated Power** and tolerance(s) can be found in section 2.5.

## 7. Measurements, Examinations and Derived Results

### 7.1. General Comments

This section contains test results only.

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to section 8 for details of measurement uncertainties.

## 7.2. Conducted Power Measurements

### 7.2.1. Conducted Average Power Measurement 2G: GSM850

#### GPRS850 - Measured Average Power without consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Note
128	824.2	31.1	31.1	Conducted, GMSK
190	836.6	31.3	31.3	Conducted, GMSK
251	848.8	31.4	31.4	Conducted, GMSK

#### GPRS850 - Calculated Value with consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Note
128	824.2	22.1	25.1	Conducted, GMSK
190	836.6	22.3	25.3	Conducted, GMSK
251	848.8	22.4	25.4	Conducted, GMSK

#### Note:

##### Scale factor for uplink time slot:

- 1 Uplink: time slot ratio = 8:1  $\Rightarrow 10 \cdot \log(8/1) = 9.03 \text{ dB}$
- 2 Uplink: time slot ratio = 8:2  $\Rightarrow 10 \cdot \log(8/2) = 6.02 \text{ dB}$

**7.2.2. Conducted Average Power Measurement 2G: PCS1900  
GPRS1900 - Measured Average Power without consideration for Uplink time slots:**

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Note
512	1850.2	28.5	28.5	Conducted, GMSK
661	1880.0	28.5	28.5	Conducted, GMSK
810	1909.8	28.5	28.5	Conducted, GMSK

**GPRS1900 - Calculated Value with consideration for Uplink time slots:**

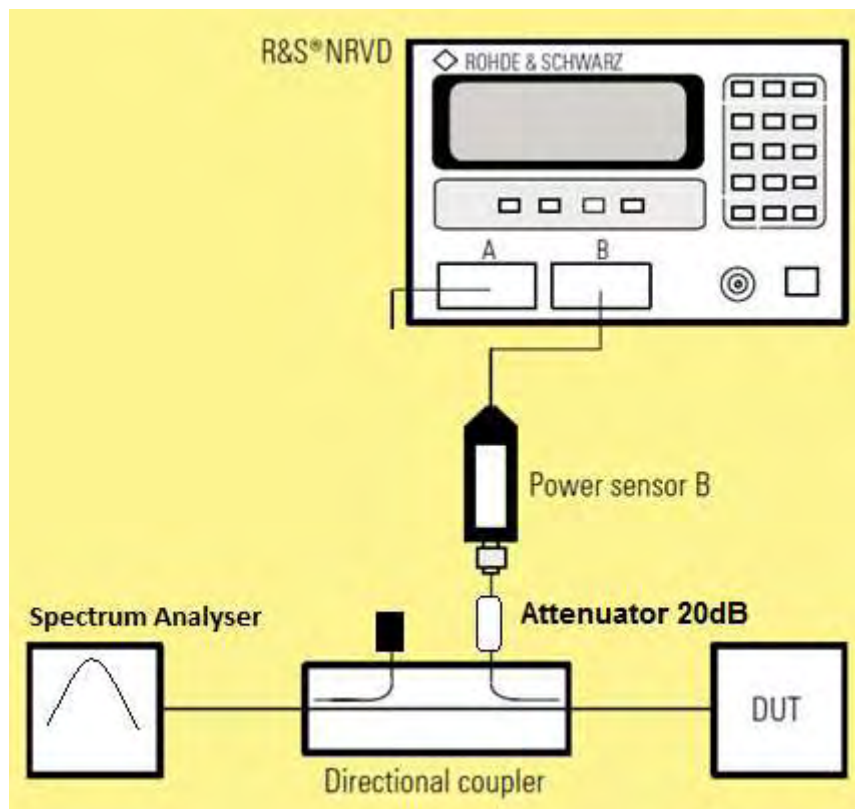
Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Note
512	1850.2	19.5	22.5	Conducted, GMSK
661	1880.0	19.5	22.5	Conducted, GMSK
810	1909.8	19.5	22.5	Conducted, GMSK

**Note:**

Scale factor for uplink time slot:

- 1 Uplink: time slot ratio = 8:1 =>  $10 \cdot \log(8/1) = 9.03 \text{ dB}$
- 2 Uplink: time slot ratio = 8:2 =>  $10 \cdot \log(8/2) = 6.02 \text{ dB}$

**Test setup for power measurements**



### 7.3. Test Results

For All SAR measurement in this report the SAR limit tested to is 1.6 W/Kg

#### 7.3.1. Specific Absorption Rate - GPRS 850 Lap Held Configuration 1g Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.014
Maximum Reported Level (W/kg):	0.021

#### Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.5 to 22.5

#### Results:

Scan No.	EUT Position	Channel Number	Meas. Avg Power (dBm)	Max Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
1	Back of EUT Facing Phantom	190	25.3	27.0	0.014	0.021	1, 2	GMSK

#### Note(s):

1. Data - SAR measurements were performed using 2 uplink timeslots
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 0mm from the 'SAM' phantom flat section.
3. For frequency bands with an operating range of < 100 MHz, when the reported SAR for the highest output power channel within is  $\leq 0.8$  W/kg, SAR for the remaining channels is not required. As per KDB 447498, section 4.

**7.3.2. Specific Absorption Rate - GPRS 1900 Lap Held Configuration 1g****Test Summary:**

<b>Tissue Volume:</b>	1g
<b>Maximum Measured Level (W/kg):</b>	0.006
<b>Maximum Reported Level (W/kg):</b>	0.010

**Environmental Conditions:**

<b>Temperature Variation in Lab (°C):</b>	23.0 to 23.0
<b>Temperature Variation in Liquid (°C):</b>	23.0 to 23.0

**Results:**

Scan No.	EUT Position	Channel Number	Meas. Avg Power (dBm)	Max Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
2	Back of EUT Facing Phantom	661	22.5	24.5	0.006	0.010	1, 2	GMSK

**Note(s):**

1. Data - SAR measurements were performed using 2 uplink timeslots
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 0mm from the 'SAM' phantom flat section.
3. For frequency bands with an operating range of < 100 MHz, when the reported SAR for the highest output power channel within is  $\leq 0.8$  W/kg, SAR for the remaining channels is not required. As per KDB 447498, section 4.

### 7.3.3. Estimated SAR for WLAN 2.4 GHz and *Bluetooth*

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

- *(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] [ $\sqrt{f_{\text{GHz}}/x}$ ] W/kg for test separation distances  $\leq 50$  mm;*  
*where  $x = 7.5$  for 1-g SAR, and  $x = 18.75$  for 10-g SAR.*
  - **0mm WLAN 2.4GHz SAR level:**  
**Estimated *WiFi 802.11b/g 1g* SAR level =  $(15.4\text{mW}/60\text{mm}) * (\sqrt{2.4 / 7.5}) = 0.053$  W/kg**
  - **0mm Bluetooth estimated SAR level:**  
**Estimated *Bluetooth 1g* SAR level =  $(21.9\text{mW}/60\text{mm}) * (\sqrt{2.4 / 7.5}) = 0.075$  W/kg**

## 8. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Test Name	Confidence Level	Calculated Uncertainty
Specific Absorption Rate- GPRS 850 Lap Held Configuration 1g	95%	±20.07%
Specific Absorption Rate- GPRS1900 Lap Held Configuration 1g	95%	±20.00%

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.



**8.1. Specific Absorption Rate- GPRS 850 Lap Held Configuration 1g**

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C <sub>i</sub> (1g)	Standard Uncertainty		v <sub>i</sub> or v <sub>eff</sub>
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration /Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.900	2.900	normal (k=1)	1.0000	1.0000	2.900	2.900	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	4.690	4.690	normal (k=1)	1.0000	0.6400	3.002	3.002	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.860	4.860	normal (k=1)	1.0000	0.6000	2.916	2.916	5
	Combined standard uncertainty			t-distribution			10.24	10.24	>250
	Expanded uncertainty			k = 1.96			20.07	20.07	>250

**8.2. Specific Absorption Rate- GPRS 1900 Lap Held Configuration 1g**

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C <sub>i</sub> (1g)	Standard Uncertainty		u <sub>i</sub> or u <sub>eff</sub>
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.500	2.500	normal (k=1)	1.0000	1.0000	2.500	2.500	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	4.940	4.940	normal (k=1)	1.0000	0.6400	3.162	3.162	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.980	4.980	normal (k=1)	1.0000	0.6000	2.988	2.988	5
	Combined standard uncertainty			t-distribution			10.20	10.20	>250
	Expanded uncertainty			k = 1.96			20.00	20.00	>250

**Appendix 1. Test Equipment Used**

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A034	Narda 20W Termination	Narda	374BNM	8706	Calibrated as part of system	-
A1097	SMA Directional Coupler	MiDISCO	MDC6223-30	None	Calibrated as part of system	-
A1137	3dB Attenuator	Narda	779	04690	Calibrated as part of system	-
A1174	Dielectric Probe Kit	Agilent Technologies	85070C	Us99360072	Calibrated before use	-
A2111	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE3	432	02 May 2012	12
A1185	Probe	Schmid & Partner Engineering AG	ET3 DV6	1528	26 Jul 2012	12
A2201	900 MHz Dipole Kit	Schmid & Partner Engineering AG	D900V2	035	16 Aug 2012	12
A2200	1900 MHz Dipole Kit	Schmid & Partner Engineering AG	D1900V2	537	14 Aug 2012	12
A1497	Amplifier	Mini-Circuits	zh1-42w (sma)	e020105	Calibrated as part of system	-
A2252	2mm Oval Phantom	Schmid & Partner Engineering AG	Eli5	1177	Calibrated before use	-
A1328	Handset Positioner	Schmid & Partner Engineering AG	Modification	SD 000 H01 DA	-	-
A1182	Handset Positioner	Schmid & Partner Engineering AG	V3.0	None	-	-
A215	20 dB Attenuator	Narda	766-20	9402	Calibrated as part of system	-
A1531	Antenna	AARONIA AG	7025	02458	-	-
A2263	Digital Camera	Samsung	PL211	9453C90B 607487L	-	-
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	09 Oct 2012	12
C1145	Cable	Rosenberger MICRO-COAX	FA147A F003003030	41843-1	Calibrated as part of system	-
C1146	Cable	Rosenberger MICRO-COAX	FA147A F030003030	41752-1	Calibrated as part of system	-
GO591	Robot Power Supply	Schmid & Partner Engineering AG	DASY4	None	Calibrated before use	-
G087	PSU	Thurlby Thandar	CPX200	100701	Calibrated before use	-
M1047	Robot Arm	Staubli	RX908 L	F00/SD8 9A1/A/01	Calibrated before use	-

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
M1647	Signal Generator	Hewlett Packward	8648C	3537A01598	01 Jun 2012	12
M1071	Spectrum Analyzer	Agilent	HP8590E	3647U00514	(Monitoring use only)	-
M1270	Digital Thermometer	RS	N/A	N/A	Internal Checked 13 May 2012	12
M1023	Dual Channel Power Meter	R & S	NRVD	863715/030	18 July 2012	12
S512	SAR Lab	UL	Site 57	N/A	Calibrated before use	-

**Note:**

All the assets were in calibration during the course of testing.

**A.1.1. Calibration Certificates**

This section contains the calibration certificates and data for the Probe(s) and Dipole(s) used, which are not included in the total number of pages for this report.

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **RFI**

Certificate No: **ET3-1528\_Jul12**

## CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1528**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4**  
**Calibration procedure for dosimetric E-field probes**



Calibration date: **July 26, 2012**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

Calibrated by:	Name <b>Jeton Kastrati</b>	Function Laboratory Technician	Signature 
Approved by:	<b>Katja Pokovic</b>	Technical Manager	

Issued: July 26, 2012

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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Accreditation No.: **SCS 108**

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### Glossary:

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization $\phi$	$\phi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

### Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the  $E^2$ -field uncertainty inside TSL (see below *ConvF*).
- NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* *frequency\_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* *ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

# Probe ET3DV6

## SN:1528

Manufactured: March 21, 2000  
Calibrated: July 26, 2012

Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)



## DASY/EASY - Parameters of Probe: ET3DV6 - SN:1528

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	1.45	1.86	1.61	± 10.1 %
DCP (mV) <sup>B</sup>	95.5	97.5	100.3	

### Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	0.00	X	0.00	0.00	1.00	166.6	±1.9 %
			Y	0.00	0.00	1.00	160.4	
			Z	0.00	0.00	1.00	170.5	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

## DASY/EASY - Parameters of Probe: ET3DV6 - SN:1528

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	43.5	0.87	7.01	7.01	7.01	0.23	2.32	± 13.4 %
750	41.9	0.89	6.37	6.37	6.37	0.49	2.16	± 12.0 %
835	41.5	0.90	6.06	6.06	6.06	0.61	1.95	± 12.0 %
900	41.5	0.97	5.95	5.95	5.95	0.30	3.00	± 12.0 %
1450	40.5	1.20	5.22	5.22	5.22	0.49	2.80	± 12.0 %
1750	40.1	1.37	5.12	5.12	5.12	0.80	2.07	± 12.0 %
1900	40.0	1.40	4.92	4.92	4.92	0.80	2.10	± 12.0 %
2150	39.7	1.53	4.65	4.65	4.65	0.80	2.00	± 12.0 %
2450	39.2	1.80	4.31	4.31	4.31	0.80	1.74	± 12.0 %

<sup>C</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

## DASY/EASY - Parameters of Probe: ET3DV6 - SN:1528

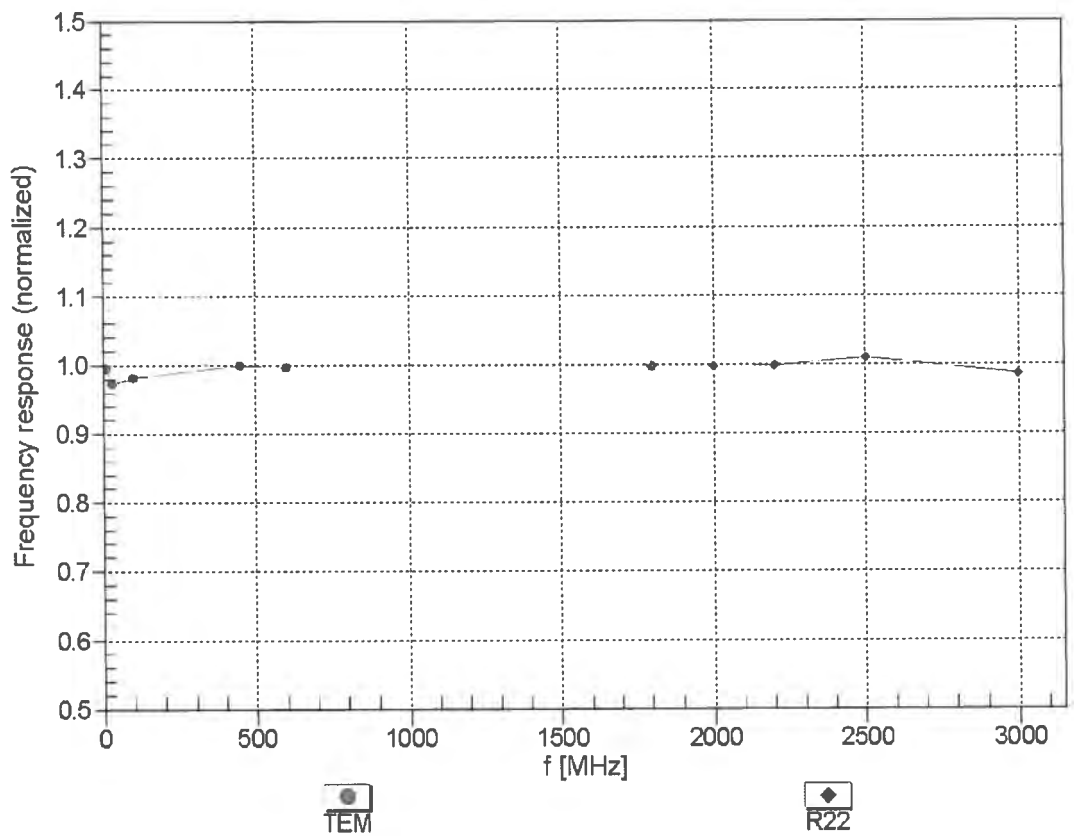
### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	7.47	7.47	7.47	0.16	2.32	± 13.4 %
750	55.5	0.96	6.17	6.17	6.17	0.33	2.75	± 12.0 %
835	55.2	0.97	5.99	5.99	5.99	0.33	3.00	± 12.0 %
900	55.0	1.05	5.92	5.92	5.92	0.55	2.18	± 12.0 %
1450	54.0	1.30	5.11	5.11	5.11	0.76	2.07	± 12.0 %
1750	53.4	1.49	4.64	4.64	4.64	0.80	2.45	± 12.0 %
1900	53.3	1.52	4.42	4.42	4.42	0.80	2.33	± 12.0 %
2150	53.1	1.66	4.37	4.37	4.37	0.80	1.93	± 12.0 %
2450	52.7	1.95	3.99	3.99	3.99	0.56	0.98	± 12.0 %

<sup>C</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

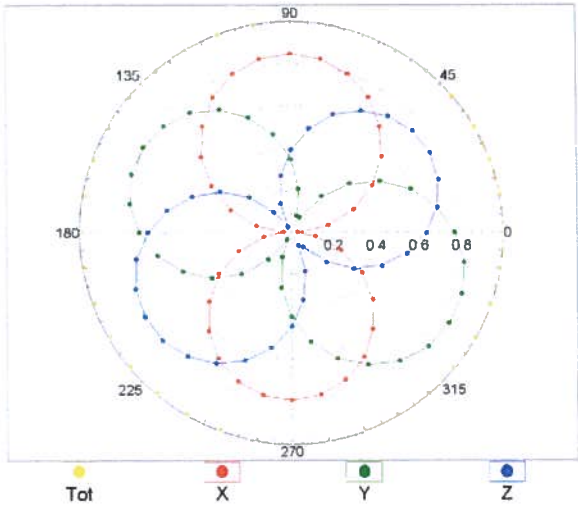
**Frequency Response of E-Field**  
(TEM-Cell:ifi110 EXX, Waveguide: R22)



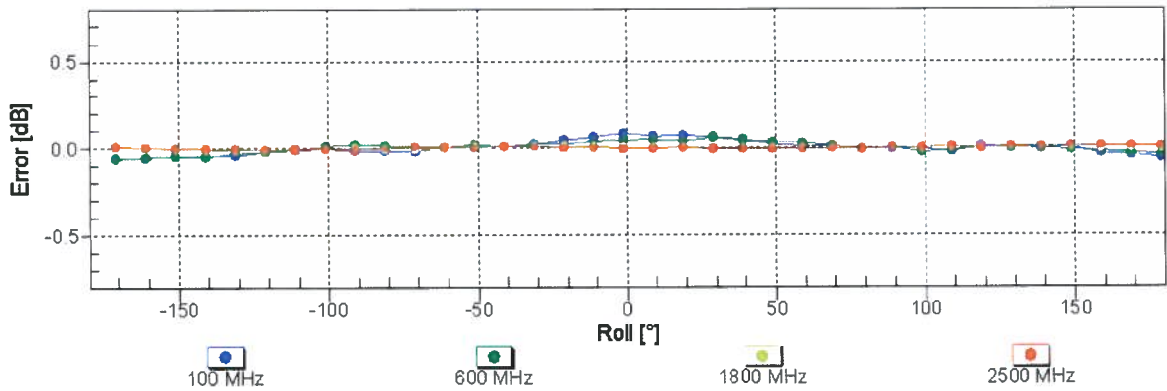
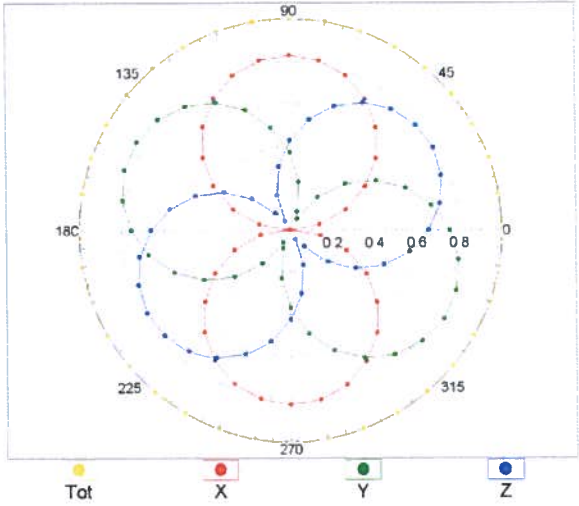
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

Receiving Pattern ( $\phi$ ),  $\vartheta = 0^\circ$

f=600 MHz,TEM

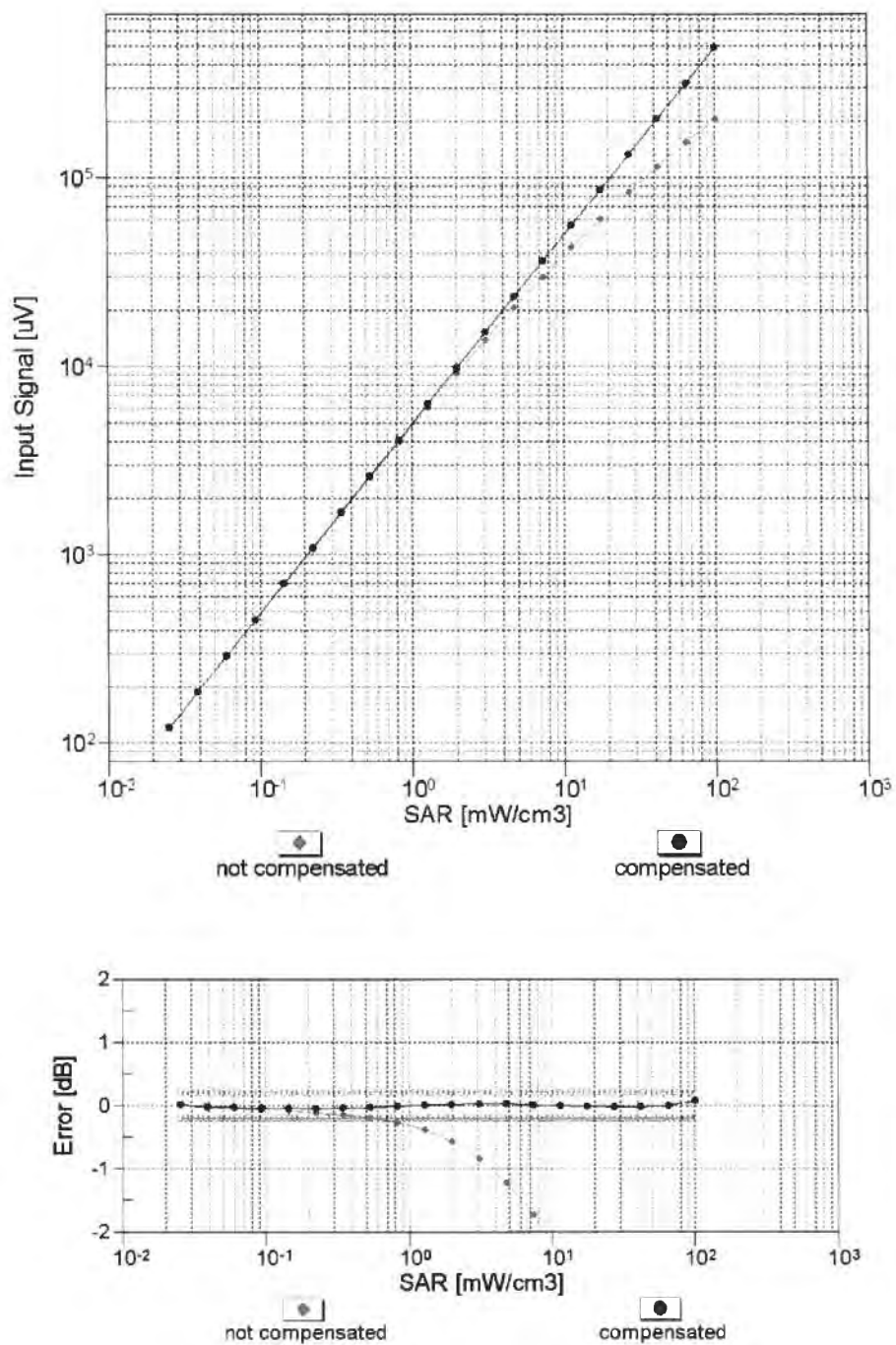


f=1800 MHz,R22



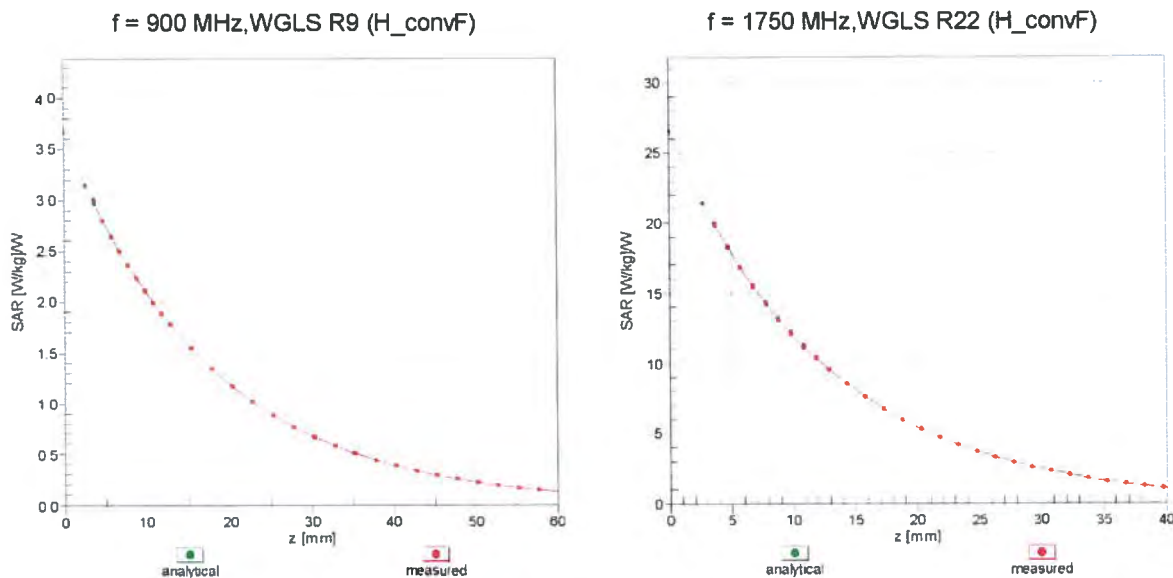
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

## Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f = 900 \text{ MHz}$ )



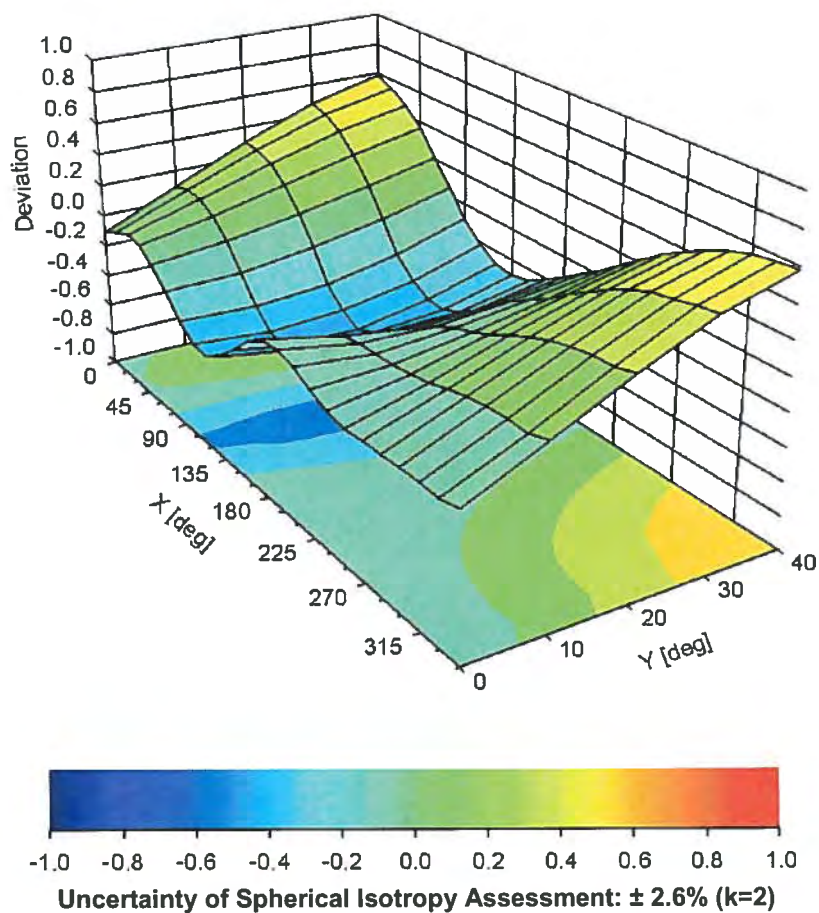
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

Error ( $\phi, \theta$ ),  $f = 900 \text{ MHz}$



## DASY/EASY - Parameters of Probe: ET3DV6 - SN:1528

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	18.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm





check by *[Signature]* DATE: 7-August 2012

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Accreditation No.: **SCS 108**

Client **RFI**

Certificate No: **D900V2-035\_Aug12**

## CALIBRATION CERTIFICATE

Object **D900V2 - SN: 035**

Calibration procedure(s) **QA CAL-05.v8**  
**Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **August 16, 2012**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

Calibrated by: **Israe El-Naouq** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Technical Manager

Signature  
*[Signature of Israe El-Naouq]*  
*[Signature of Katja Pokovic]*

Issued: August 16, 2012

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Accredited by the Swiss Accreditation Service (SAS)

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

### Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

### Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

## Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	900 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.97 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.6 $\pm$ 6 %	0.96 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

## SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.62 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	10.5 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.68 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.74 mW / g $\pm$ 16.5 % (k=2)

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.0	1.05 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.6 $\pm$ 6 %	1.06 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

## SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.74 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	10.8 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.76 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.96 mW / g $\pm$ 16.5 % (k=2)

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.8 $\Omega$ - 5.8 j $\Omega$
Return Loss	- 24.4 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.5 $\Omega$ - 5.5 j $\Omega$
Return Loss	- 24.2 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.404 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	February 26, 1998

## DASY5 Validation Report for Head TSL

Date: 16.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 035**

Communication System: CW; Frequency: 900 MHz

Medium parameters used:  $f = 900 \text{ MHz}$ ;  $\sigma = 0.96 \text{ mho/m}$ ;  $\epsilon_r = 40.6$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.97, 5.97, 5.97); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

### **Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:**

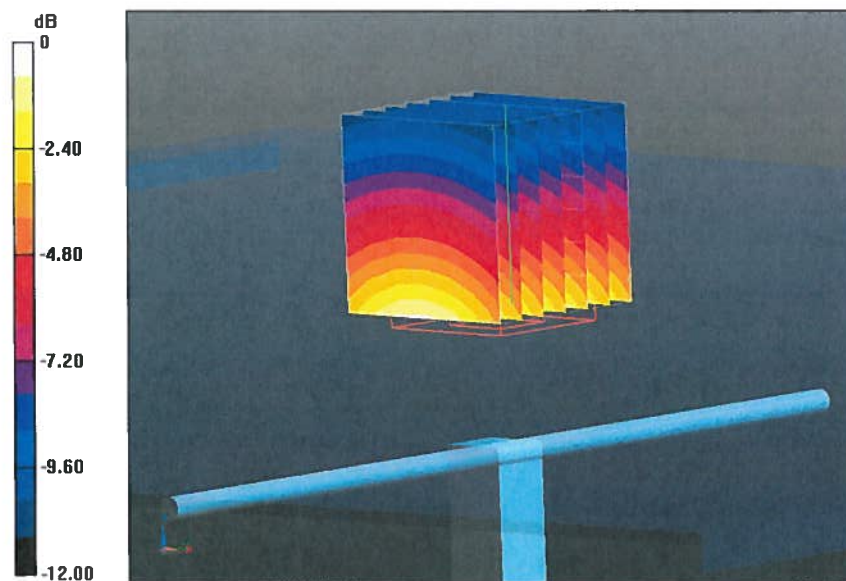
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 56.325 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.926 mW/g

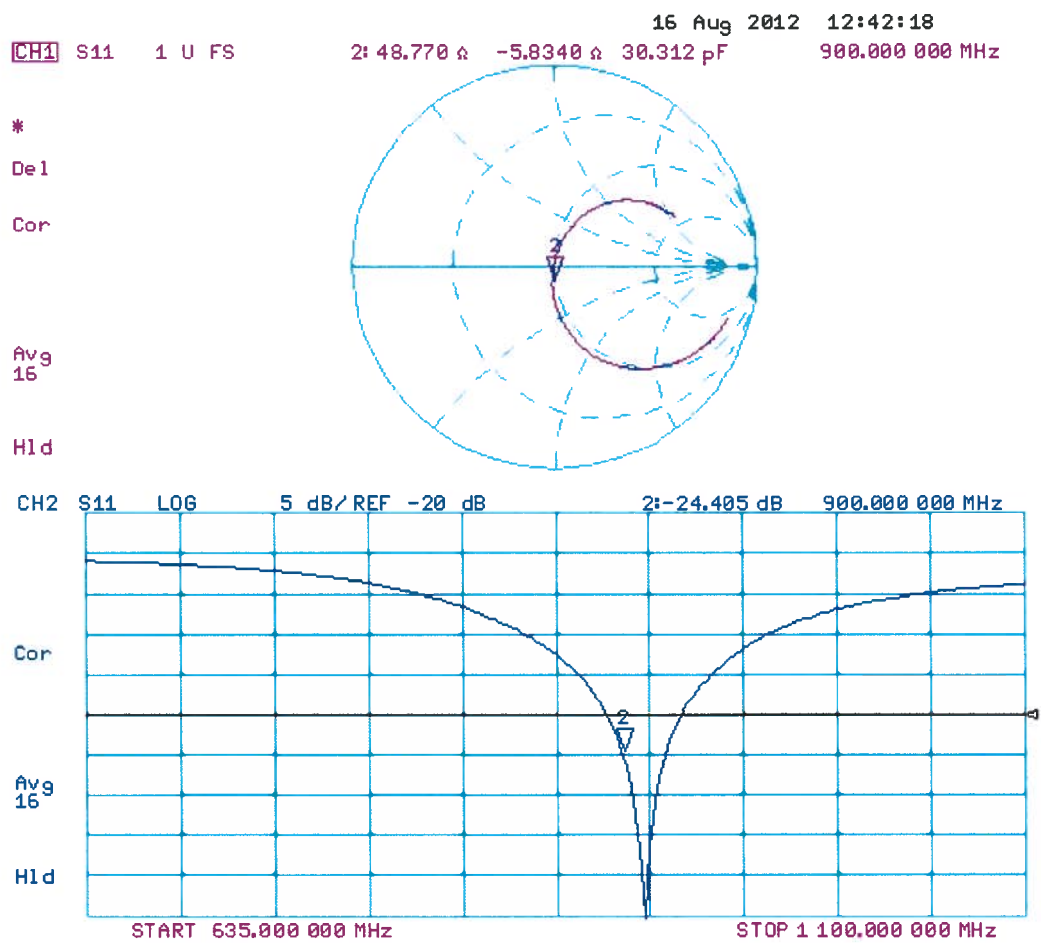
**SAR(1 g) = 2.62 mW/g; SAR(10 g) = 1.68 mW/g**

Maximum value of SAR (measured) = 3.06 W/kg



0 dB = 3.06 W/kg = 9.71 dB W/kg

## Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 16.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 035**

Communication System: CW; Frequency: 900 MHz

Medium parameters used:  $f = 900 \text{ MHz}$ ;  $\sigma = 1.06 \text{ mho/m}$ ;  $\epsilon_r = 52.6$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.94, 5.94, 5.94); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

### Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

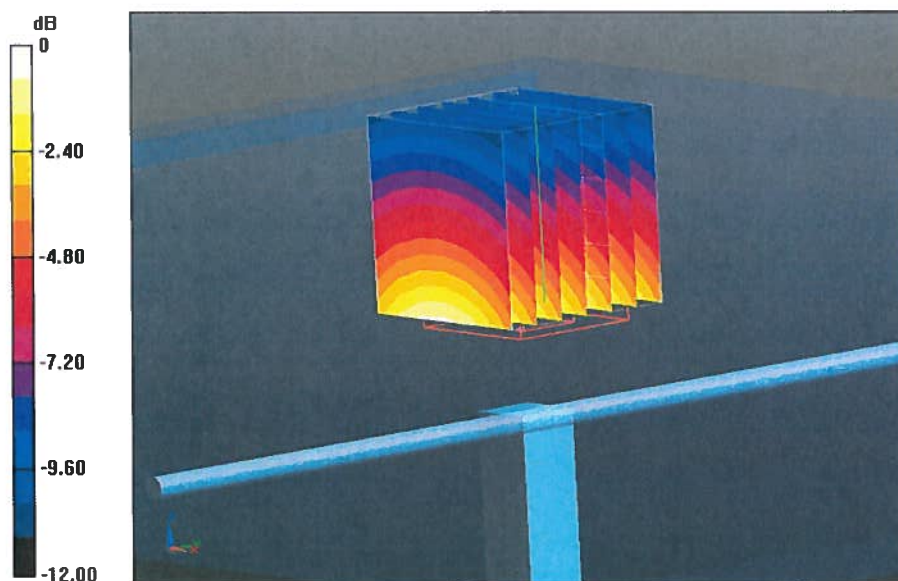
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.325 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 4.184 mW/g

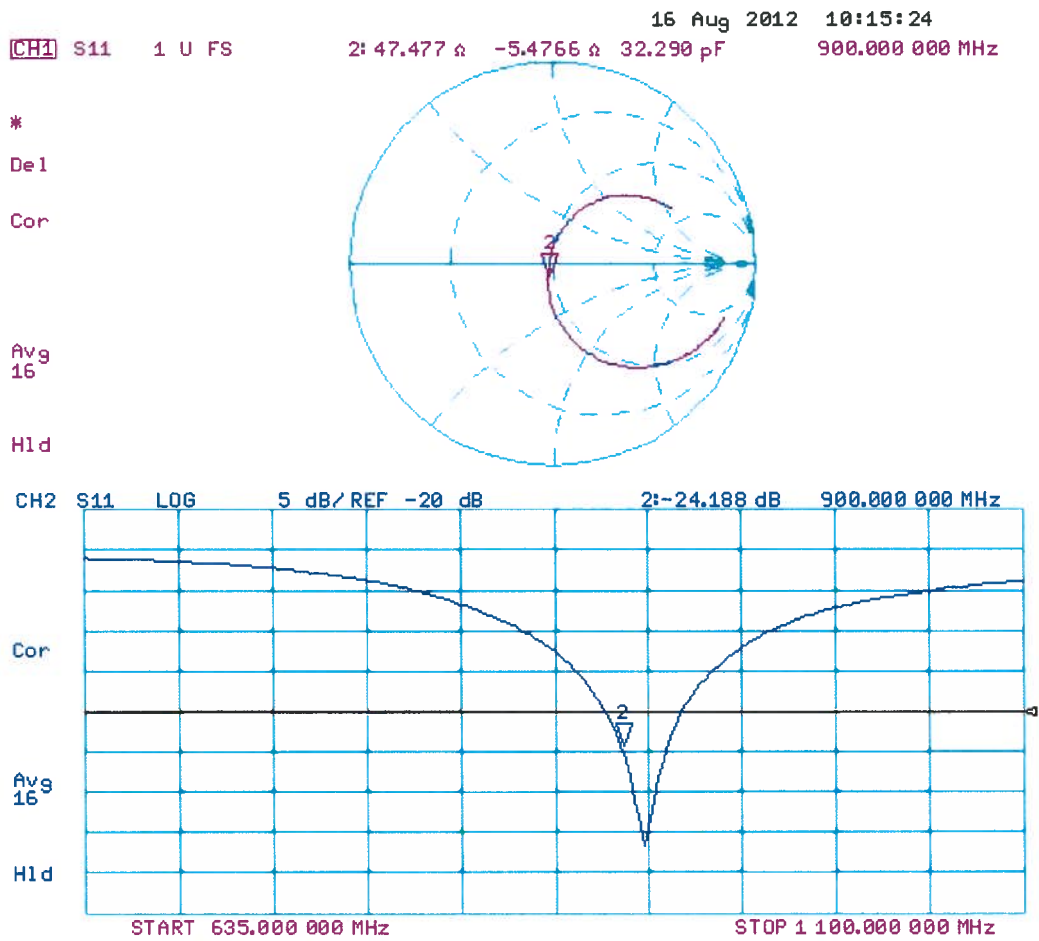
**SAR(1 g) = 2.74 mW/g; SAR(10 g) = 1.76 mW/g**

Maximum value of SAR (measured) = 3.18 W/kg



0 dB = 3.18 W/kg = 10.05 dB W/kg

Impedance Measurement Plot for Body TSL







Checked by: *[Signature]* Date: *Sept 1 2012*

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **RFI**

Certificate No: **D1900V2-537\_Aug12**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 537**

Calibration procedure(s) **QA CAL-05.v8**  
**Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **August 14, 2012**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

Calibrated by: **Israe El-Naouq** **Laboratory Technician**

Approved by: **Katja Pokovic** **Technical Manager**

Signature  
*[Signature of Israe El-Naouq]*  
*[Signature of Katja Pokovic]*

Issued: August 14, 2012

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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Accreditation No.: **SCS 108**

**Glossary:**

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

**Calibration is Performed According to the Following Standards:**

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

## Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.9 $\pm$ 6 %	1.38 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

## SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.78 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	39.4 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.16 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.7 mW / g $\pm$ 16.5 % (k=2)

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.5 $\pm$ 6 %	1.53 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

## SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	40.5 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.37 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.4 mW / g $\pm$ 16.5 % (k=2)

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.1 $\Omega$ - 5.7 j $\Omega$
Return Loss	- 24.3 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.0 $\Omega$ - 5.2 j $\Omega$
Return Loss	- 21.5 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.181 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 22, 2001

## DASY5 Validation Report for Head TSL

Date: 14.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 537**

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.38$  mho/m;  $\epsilon_r = 39.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

### Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

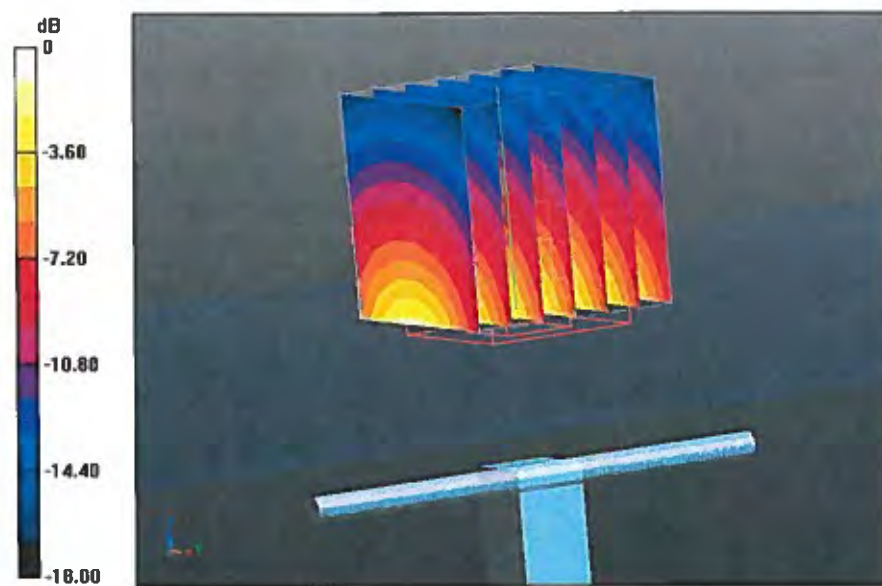
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.874 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 17.436 mW/g

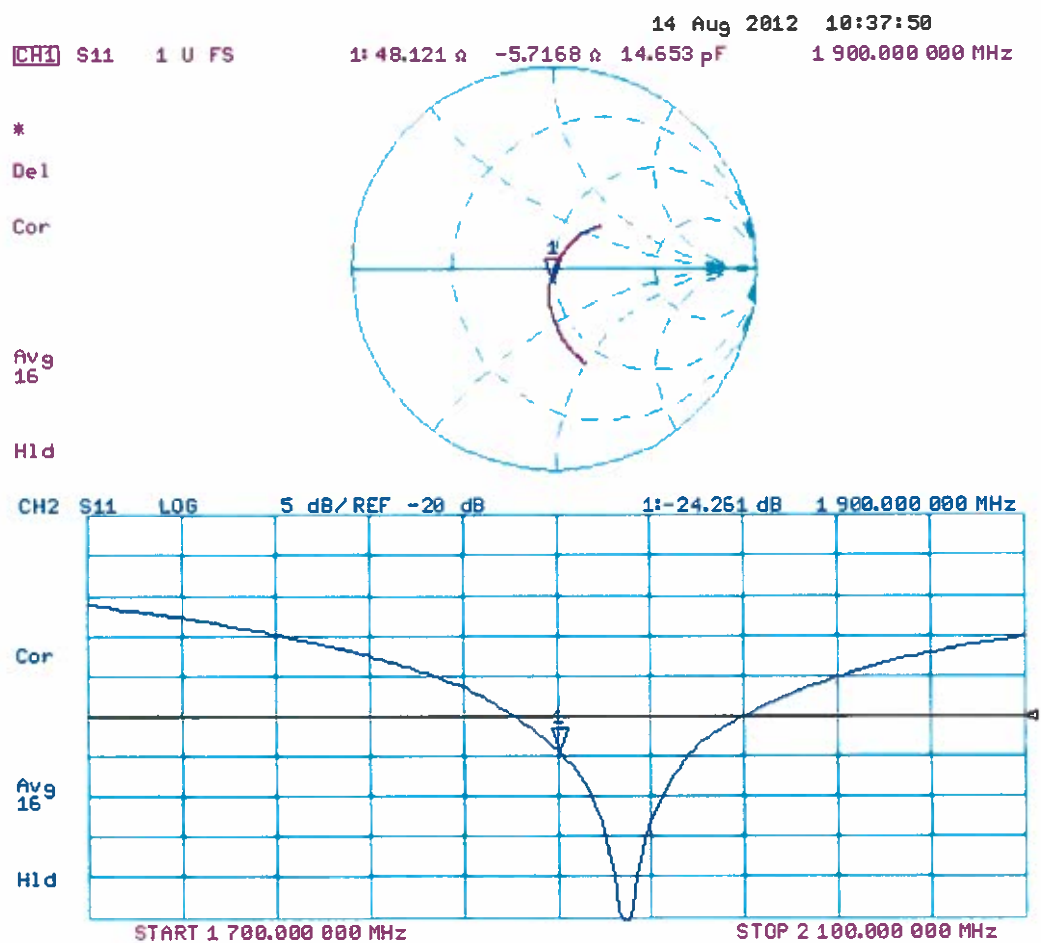
**SAR(1 g) = 9.78 mW/g; SAR(10 g) = 5.16 mW/g**

Maximum value of SAR (measured) = 11.9 W/kg



0 dB = 11.9 W/kg = 21.51 dB W/kg

## Impedance Measurement Plot for Head TSL





## DASY5 Validation Report for Body TSL

Date: 14.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 537**

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.53$  mho/m;  $\epsilon_r = 52.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

### Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

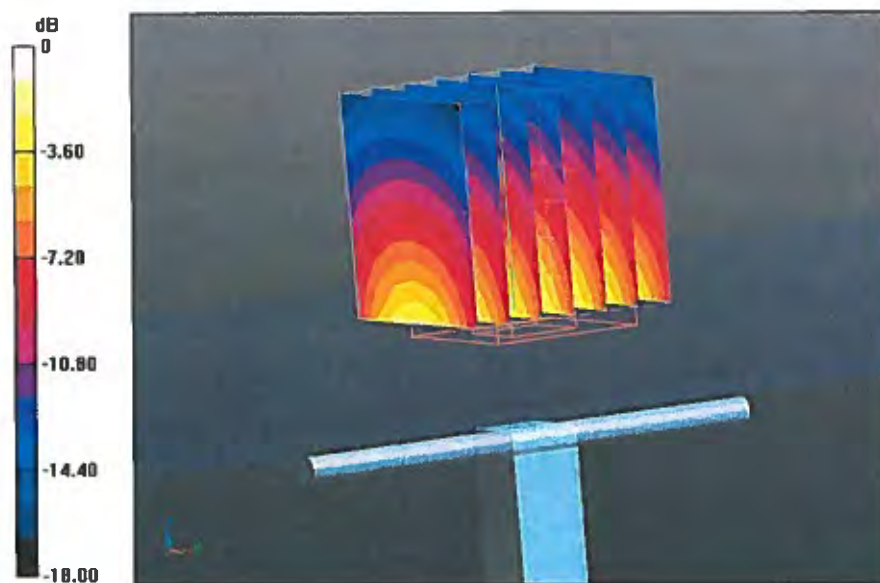
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.874 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 17.899 mW/g

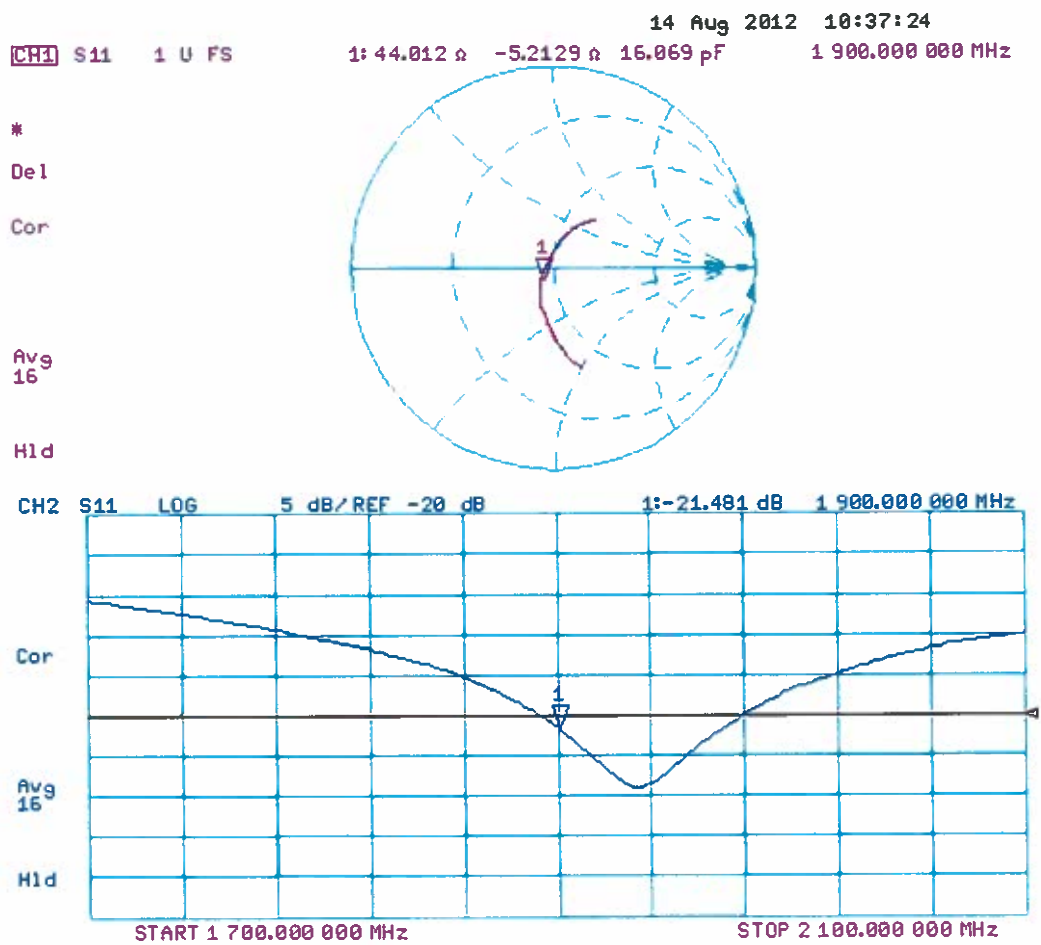
**SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.37 mW/g**

Maximum value of SAR (measured) = 12.8 W/kg



0 dB = 12.8 W/kg = 22.14 dB W/kg

# Impedance Measurement Plot for Body TSL





## Appendix 2. Measurement Methods

### A.2.1. Evaluation Procedure

The Specific Absorption Rate (SAR) evaluation was performed in the following manner:

- a) (i) The evaluation was performed in an applicable area of the phantom depending on the type of device being tested. For devices worn about the ear during normal operation, both the left and right ear positions were evaluated at the centre frequency of the band at maximum power. The side, which produced the greatest SAR, determined which side of the phantom would be used for the entire evaluation. The positioning of the head worn device relative to the phantom was dictated by the test specification identified in section 3.1 of this report.  
(ii) For body worn devices or devices which can be operated within 20 cm of the body, the flat section of the SAM phantom was used were the size of the device(s) is normal. for bigger devices and base station the 2mm Oval phantom is used for evaluation. The type of device being evaluated dictated the distance of the EUT to the outer surface of the phantom flat section.
- b) The SAR was determined by a pre-defined procedure within the DASY4 software. The exposed region of the phantom was scanned near the inner surface with a grid spacing of 20mm x 20mm or appropriate resolution.
- c) A 5x5x7 matrix for measurement < 2.0 GHz, 7x7x7 matrix for measurement 2.0 GHz to 3.0 GHz, and 7x7x12 for > 5.0 GHz was performed around the greatest spatial SAR distribution found during the area scan of the applicable exposed region. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.
- d) If the EUT had any appreciable drift over the course of the evaluation, then the EUT was re-evaluated. Any unusual anomalies over the course of the test also warranted a re-evaluation.

**A.2.2. Specific Absorption Rate (SAR) Measurements to OET Bulletin 65 Supplement C: (2001-01)**

Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields

SAR measurements were performed in accordance with Appendix D of the standard FCC OET Bulletin 65 Supplement C: 2001, IEEE 1528 and FCC KDB procedures, against appropriate limits for each measurement position in accordance with the standard. In some cases the FCC was contacted using a PBA or KDB process to ensure test is performed correctly.

The test was performed in a shielded enclosure with the temperature controlled to remain between +18.0°C and +25.0°C. The tissue equivalent material fluid temperature was controlled to give a maximum variation of  $\pm 2.0^{\circ}\text{C}$

Prior to any SAR measurements on the EUT, system Check and material dielectric property measurements were conducted. In the absence of a detailed procedure within the specification, system Check and material dielectric property measurements were performed in accordance with Appendix C and Appendix D of FCC OET Bulletin 65 Supplement C: 2001 and FCC KDB publication 865664 D01.

Following the successful system Check and material dielectric property measurements, a SAR versus time sweep shall be performed within 10 mm of the phantom inner surface. If the EUT power output is stable after three minutes then the measurement probe will perform a coarse surface level scan at each test position in order to ascertain the location of the maximum local SAR level. Once this area had been established, a 5x5x7 cube of 175 points for frequency below 2.0 GHz, above 2.0GHz up to 3.0 GHz 7x7x7 cube of 343 points and a 7x7x12 cube of 588 points for frequency 5.0 GHz and above will be centred at the area of concern. Extrapolation and interpolation will then be carried out on the 27g of tissue and the highest averaged SAR over a 1g cube determined.

Once the maximum interpolated SAR measurement is complete; the coarse scan is visually assessed to check for secondary peaks within 50% of the maximum SAR level. If there are any further SAR measurements required, extra 5x5x7 or 7x7x7 or 7x7x12 cubes shall be centred on each of these extra local SAR maxima.

At the end of each position test case a second time sweep shall be performed to check whether the EUT has remained stable throughout the test.

---

### Appendix 3. SAR Distribution Scans

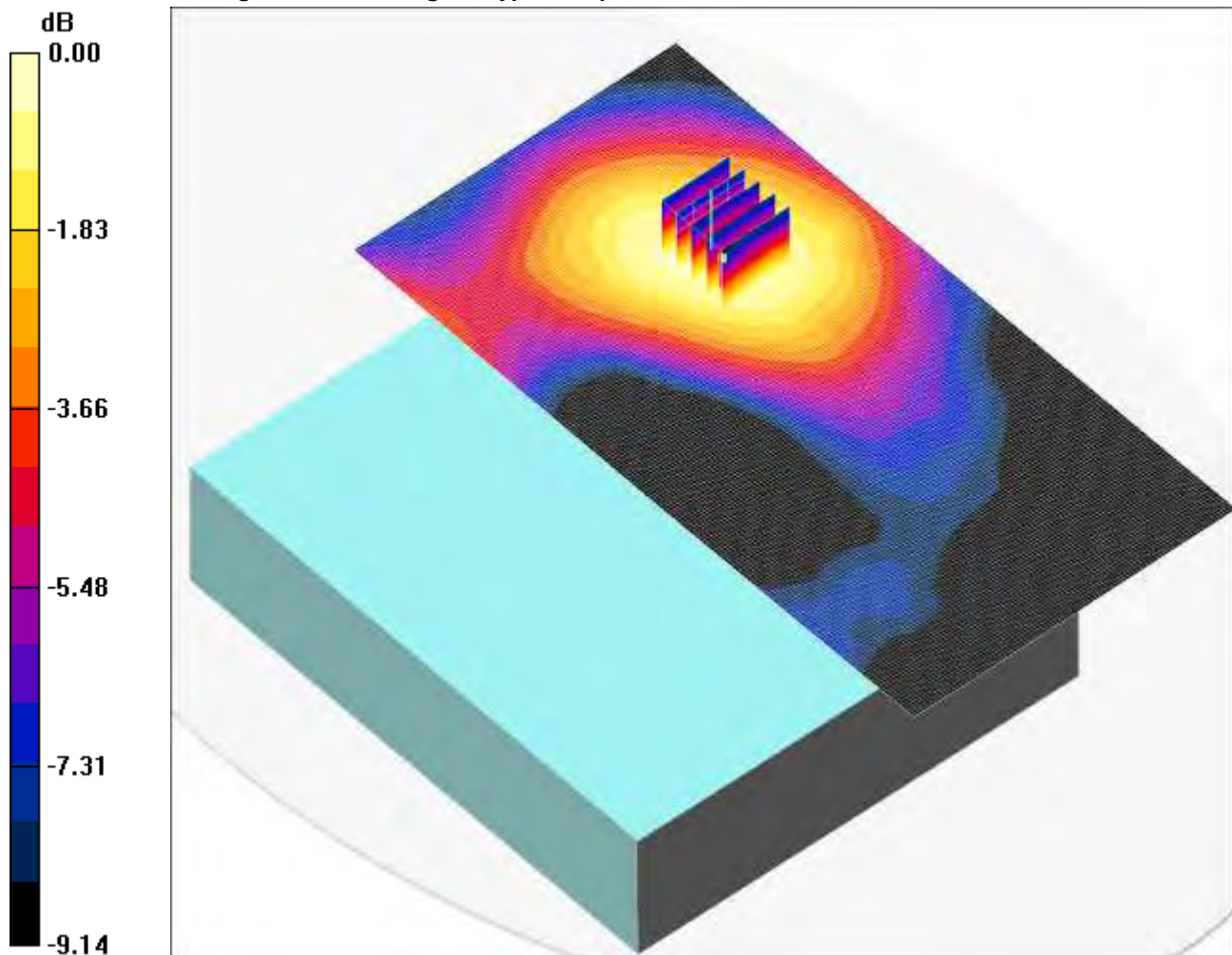
This appendix contains SAR distribution scans which are not included in the total number of pages for this report.

Scan Reference Number	Title
SCN/92460JD01/001	Back of EUT Facing Phantom GPRS CH190
SCN/92460JD01/002	Back of EUT Facing Phantom GPRS CH661
SCN/92460JD01/003	System Performance Check 900MHz Body 08 03 13
SCN/92460JD01/004	System Performance Check 1900MHz Body 08 03 13

SCN/92460JD01/001: Back of EUT Facing Phantom GPRS CH190

Date: 08/03/2013

DUT: Remote Diagnostic Technologies; Type: Tempus IC; Serial: 000673



0 dB = 0.015mW/g

Communication System: GPRS 850 MHz 2TX; Frequency: 836.6 MHz; Duty Cycle: 1:4

Medium: 900 MHz MSL Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.993$  mho/m;  $\epsilon_r = 54.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1528; ConvF(5.99, 5.99, 5.99); Calibrated: 26/07/2012

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn432; Calibrated: 02/05/2012

- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

**Front of EUT Facing Phantom - Middle 2/Area Scan 2 (101x201x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.014 mW/g

**Front of EUT Facing Phantom - Middle 2/Zoom Scan (5x5x7) 2 2 2 (5x5x7)/Cube 0:** Measurement grid:

dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.69 V/m; Power Drift = 0.059 dB

Peak SAR (extrapolated) = 0.017 W/kg

**SAR(1 g) = 0.014 mW/g; SAR(10 g) = 0.010 mW/g**

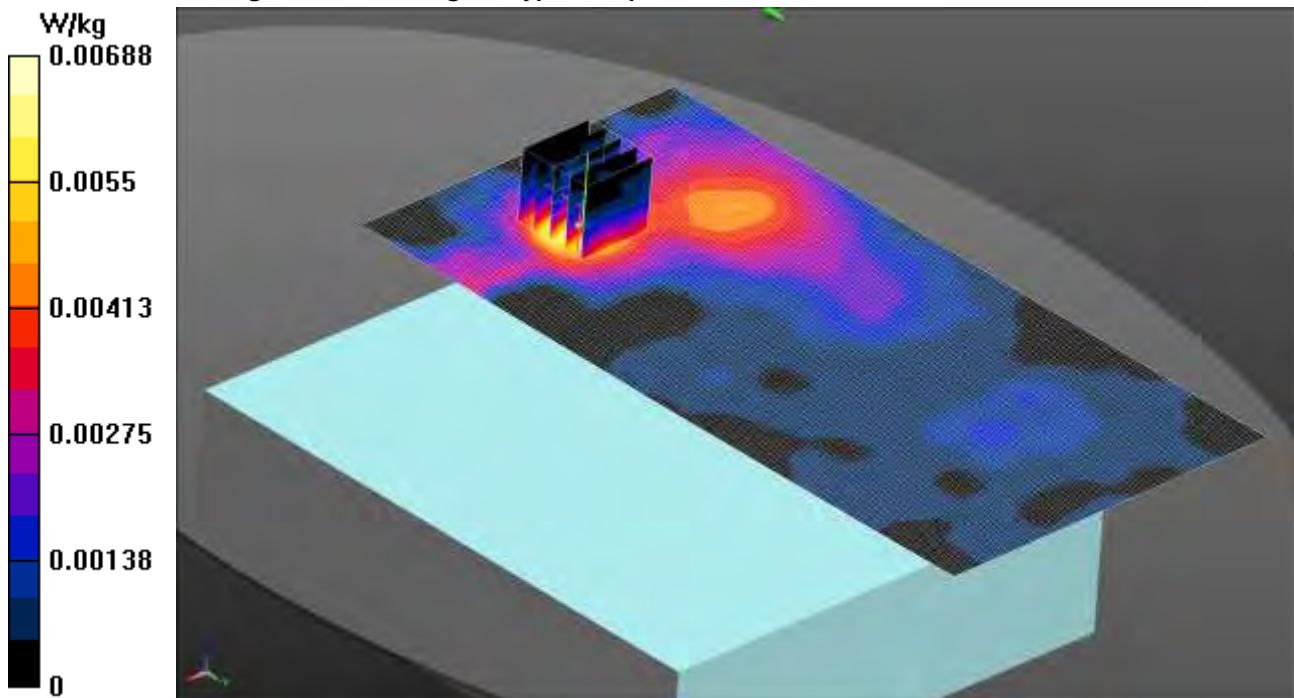
Maximum value of SAR (measured) = 0.015 mW/g

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SCN/92460JD01/002: Back of EUT Facing Phantom GPRS CH661

Date: 08/03/2013

DUT: Remote Diagnostic Technologies; Type: Tempus IC; Serial: 000673



Communication System: GPRS 1900 2Tx; Frequency: 1880 MHz; Duty Cycle: 1:4

Medium: 1900 MHz MSL Medium parameters used (interpolated):  $f = 1880$  MHz;  $\sigma = 1.51$  mho/m;  $\epsilon_r = 51.372$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1528; ConvF(4.42, 4.42, 4.42); Calibrated: 26/07/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn432; Calibrated: 02/05/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- ; SEMCAD X Version 14.6.7 (6848)

**Configuration/Back of EUT Facing Phantom - Middle/Area Scan 2 (101x201x1):** Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 0.00651 W/kg

**Configuration/Back of EUT Facing Phantom - Middle/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:  $dx=8$  mm,  $dy=8$  mm,  $dz=5$  mm

Reference Value = 2.240 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 0.00919 W/kg

**SAR(1 g) = 0.00622 W/kg; SAR(10 g) = 0.00394 W/kg**

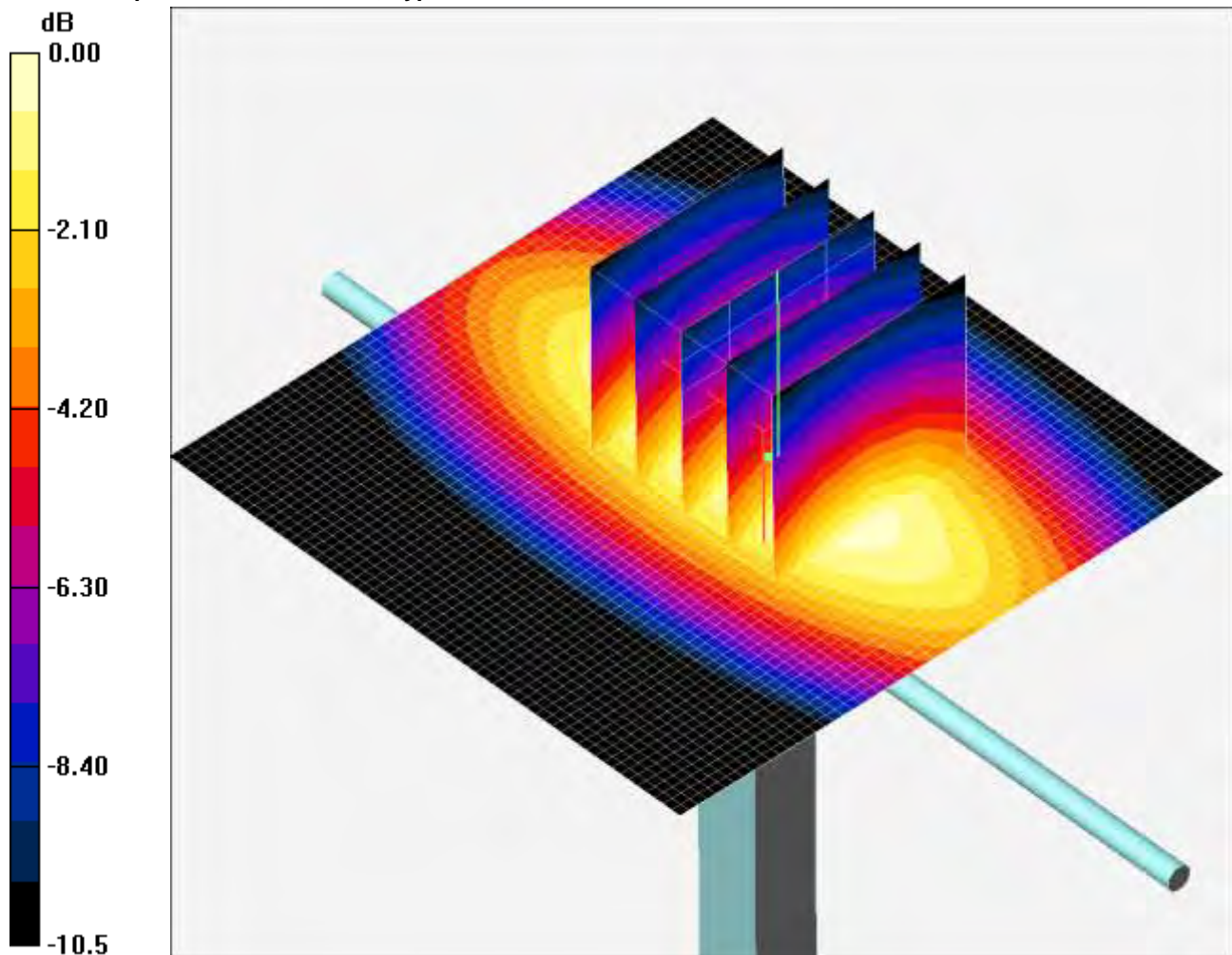
Maximum value of SAR (measured) = 0.00688 W/kg



SCN/92460JD01/003: System Performance Check 900MHz Body 08 03 13

Date: 08/03/2013

DUT: Dipole 900 MHz; SN: 035; Type: D900V2; Serial: SN035



0 dB = 2.88mW/g

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: 900 MHz MSL Medium parameters used:  $f = 900 \text{ MHz}$ ;  $\sigma = 1.03 \text{ mho/m}$ ;  $\epsilon_r = 53.9$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1528; ConvF(5.92, 5.92, 5.92); Calibrated: 26/07/2012

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn432; Calibrated: 02/05/2012

- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

**d=10mm, Pin=250mW/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 2.92 mW/g

**d=10mm, Pin=250mW/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 55.4 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.75 W/kg

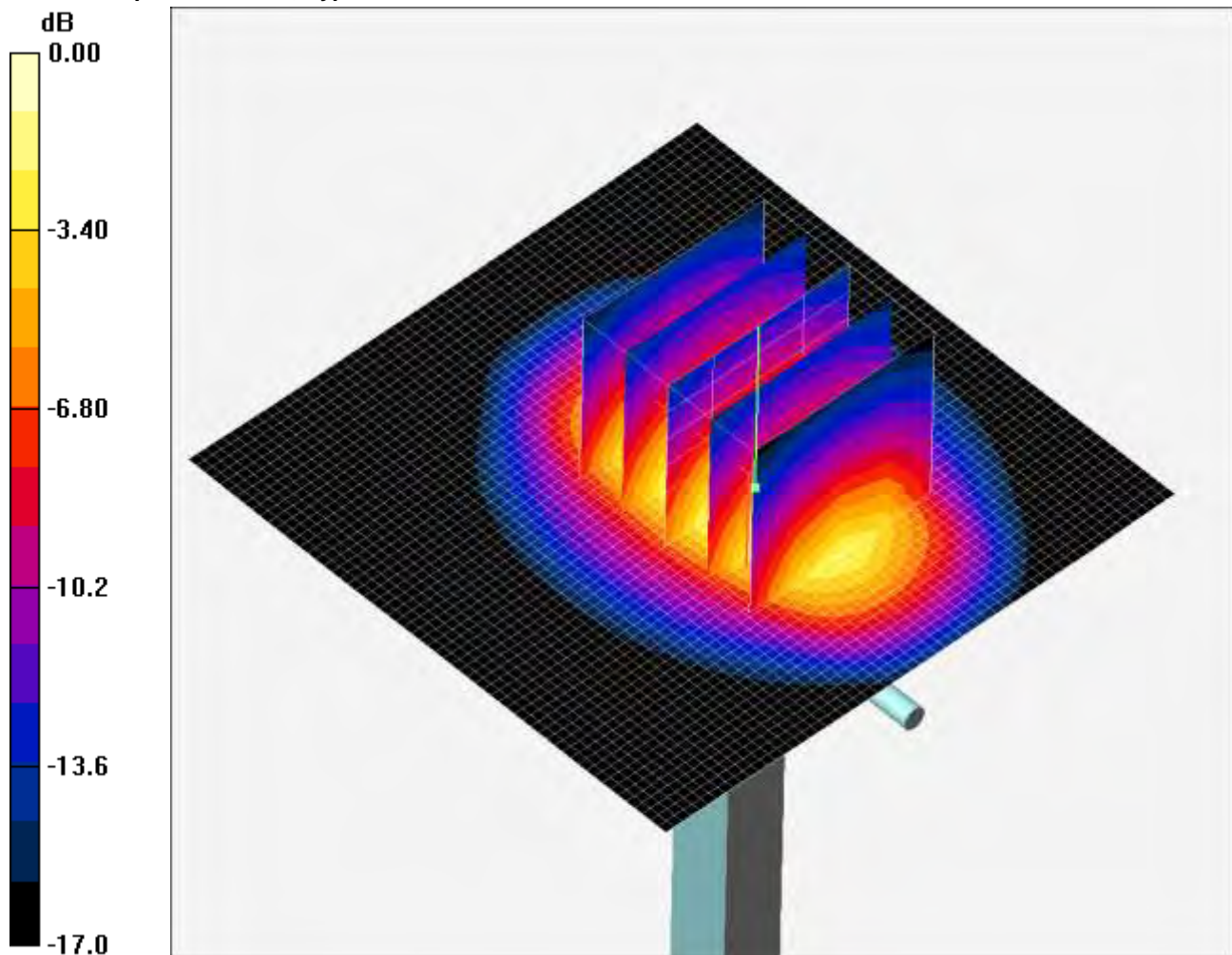
**SAR(1 g) = 2.68 mW/g; SAR(10 g) = 1.77 mW/g**

Maximum value of SAR (measured) = 2.88 mW/g

SCN/92460JD01/004: System Performance Check 1900MHz Body 08 03 13

Date: 08/03/2013

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: SN537



0 dB = 11.0mW/g

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 MHz MSL Medium parameters used:  $f = 1900 \text{ MHz}$ ;  $\sigma = 1.53 \text{ mho/m}$ ;  $\epsilon_r = 51.3$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1528; ConvF(4.42, 4.42, 4.42); Calibrated: 26/07/2012

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn432; Calibrated: 02/05/2012

- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

**d=10mm, Pin=250mW/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 12.4 mW/g

**d=10mm, Pin=250mW/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 89.4 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 15.9 W/kg

**SAR(1 g) = 9.78 mW/g; SAR(10 g) = 5.31 mW/g**

Maximum value of SAR (measured) = 11.0 mW/g

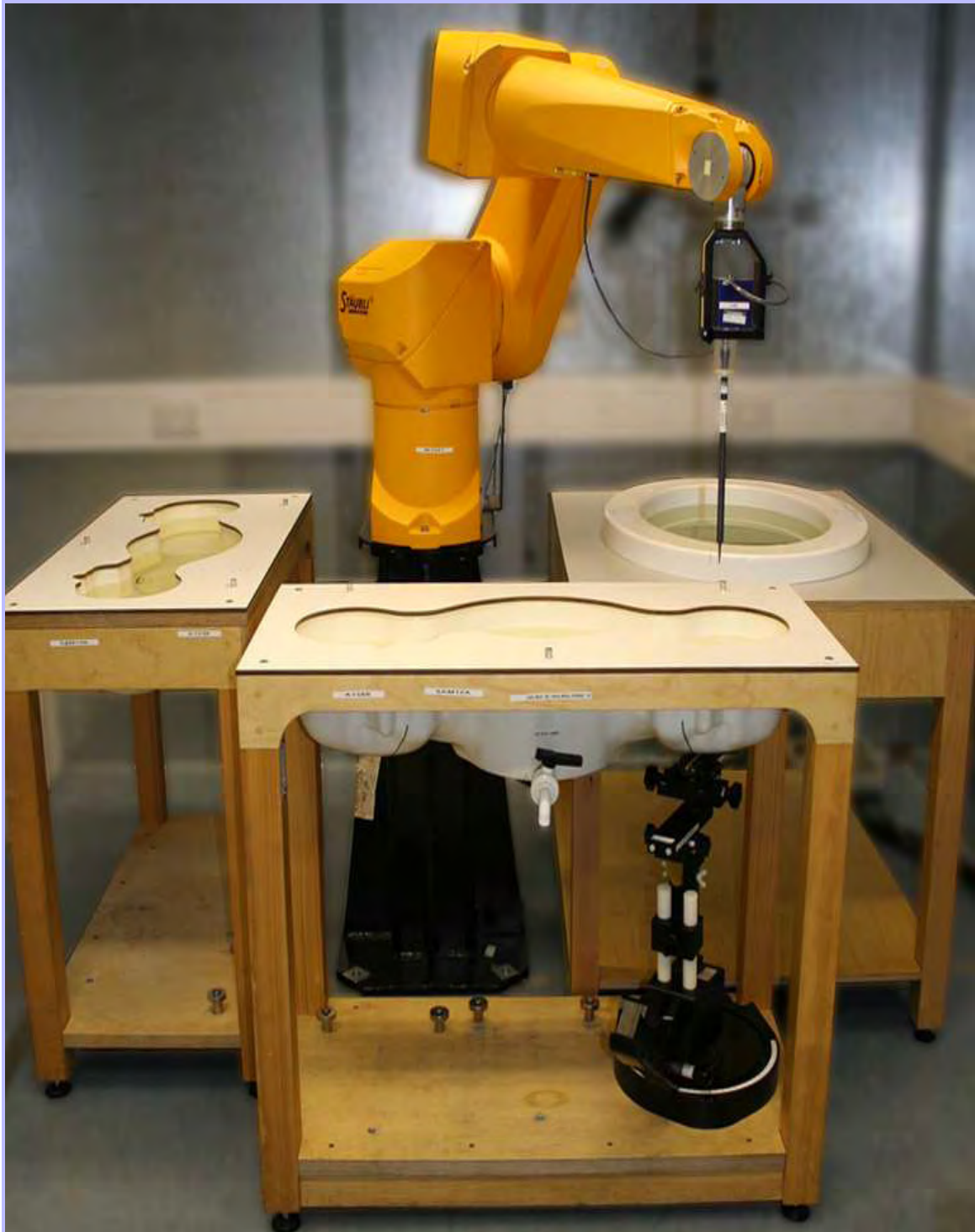
#### Appendix 4. Photographs

This appendix contains the following photographs:

Photo Reference Number	Title
PHT/92460JD01/001	Test configuration for the measurement of Specific Absorption Rate (SAR)
PHT/92460JD01/002	Back of EUT Facing Phantom 0mm
PHT/92460JD01/003	Front View of EUT
PHT/92460JD01/004	Back View of EUT
PHT/92460JD01/005	Top View of EUT
PHT/92460JD01/006	Bottom View of EUT
PHT/92460JD01/007	Side View of EUT
PHT/92460JD01/008	Internal View of EUT without Battery Attached
PHT/92460JD01/009	Front View of Battery
PHT/92460JD01/010	Back View of Battery
PHT/92460JD01/011	900MHz Body Fluid
PHT/92460JD01/012	1900MHz Body Fluid



**PHT/92460JD01/001: Test configuration for the measurement of Specific Absorption Rate (SAR)**



PHT/92460JD01/002: Back of EUT Facing Phantom at 0mm



**Note:** EUT was configured with the most conservative and the RF antenna is at closest separation distance to the phantom flat section.

PHT/92460JD01/003: Front View of EUT



Membrane Buttons

Battery

Touchscreen

Jog Wheel

PHT/92460JD01/004: Back View of EUT





PHT/92460JD01/005: Top View of EUT



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PHT/92460JD01/006: Bottom View of EUT



PHT/92460JD01/007: Side View of EUT



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PHT/92460JD01/008: Internal View of EUT without Battery Attached





PHT/92460JD01/009: Front View of Battery

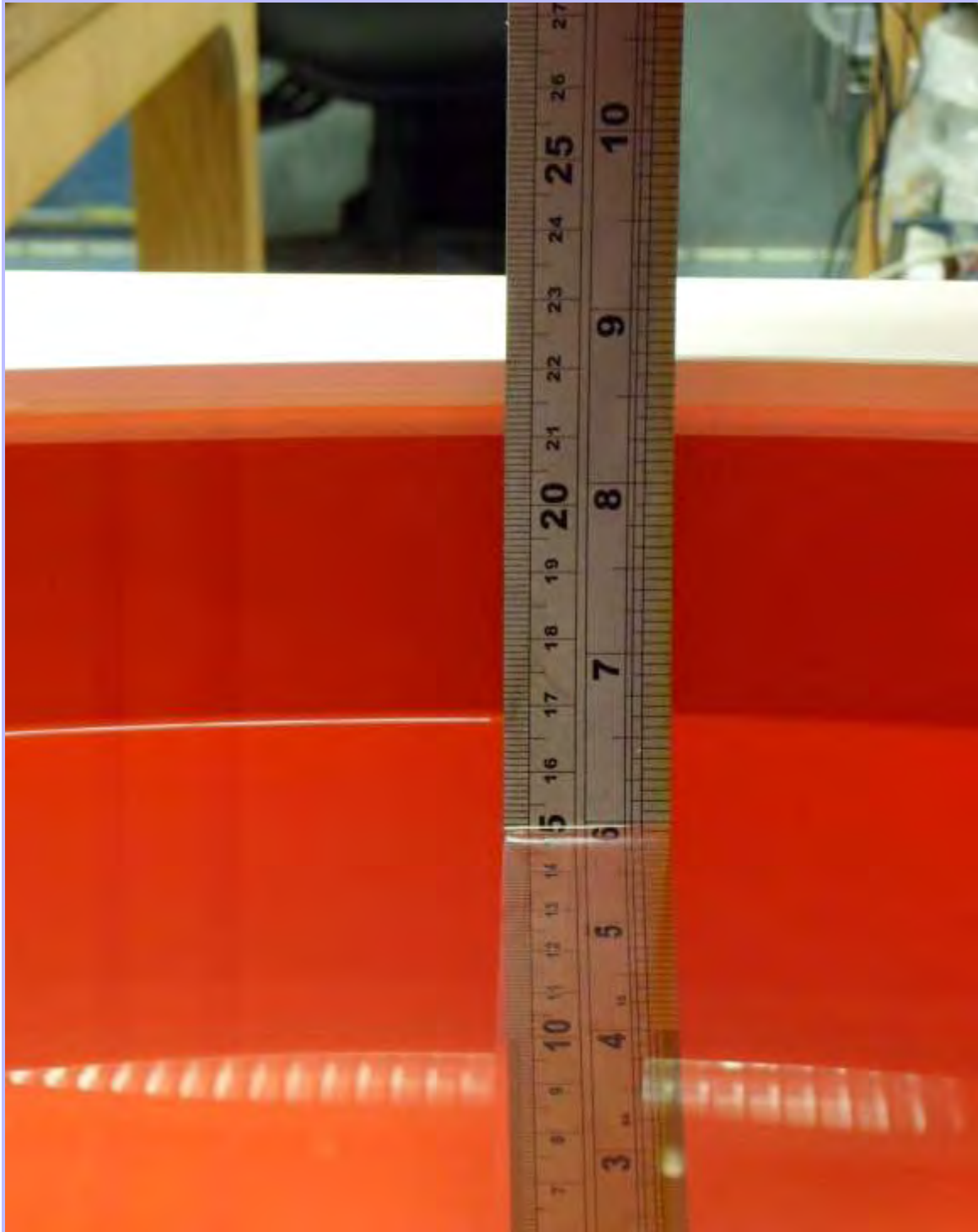


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PHT/92460JD01/010: Back View of Battery



PHT/92460JD01/011: 900MHz Body Fluid



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PHT/92460JD01/012: 1900MHz Body Fluid



## Appendix 5. System Check

Prior to the assessment, the system was verified in the flat region of the phantom, 900 MHz, 1900 MHz and 2450 MHz dipoles were used. A forward power of 250 mW was applied to the 900 MHz, 1900 MHz and 2450 MHz dipoles and the system was verified to a tolerance of  $\pm 5\%$  for the 900MHz, 1900MHz and 2450 MHz dipoles.

The applicable verification normalised to 1 Watt.

### System Check 900 Body

Date: 08/03/2013

Validation Dipole and Serial Number: D900V2; SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0 °C	22.5 °C	$\epsilon_r$	55.00	53.86	-2.07	5.00
				$\sigma$	1.05	1.03	-1.76	5.00
				1g SAR	10.80	10.72	-0.74	5.00
				10g SAR	6.96	7.08	1.72	5.00

### System Check 1900 Body

Date: 08/03/2013

Validation Dipole and Serial Number: D1900V2; SN: 537

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1900	23.0 °C	23.0 °C	$\epsilon_r$	53.30	51.33	-3.70	5.00
				$\sigma$	1.52	1.53	0.49	5.00
				1g SAR	40.50	39.12	-3.41	5.00
				10g SAR	21.40	21.24	-0.75	5.00

**Appendix 6. Simulated Tissues**

The body mixture consists of water, Polysorbate (Tween 20) and salt. Visual inspection is made to ensure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the tissue.

Ingredient (% by weight)	Frequency
	750/835/850/900 MHz Body
De-Ionized Water	71.30
Polysorbate 20	28.00
Salt	0.70

Ingredient (% by weight)	Frequency
	1800/1900 MHz Body
De-Ionized Water	71.50
Polysorbate 20	28.00
Salt	0.50

## Appendix 7. DASY4 System Details

### A.7.1. DASY4 SAR Measurement System

UL, SAR measurement facility utilises the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY4 system is comprised of the robot controller, computer, near-field probe, probe alignment sensor, and the SAM phantom containing brain or muscle equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller; teach pendant (Joystick), and remote control. This is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. The data acquisition electronics (DAE) performs signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection etc. The DAE is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card. The DAE3 utilises a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

### A.7.2. DASY4 SAR System Specifications

#### Robot System

Positioner:	Stäubli Unimation Corp. Robot Model: RX90L
Repeatability:	0.025 mm
No. of Axis:	6
Serial Number:	F01/5J86A1/A/01
Reach:	1185 mm
Payload:	3.5 kg
Control Unit:	CS7
Programming Language:	V+

#### Data Acquisition Electronic (DAE) System

Serial Number:	DAE3 SN:432
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#### PC Controller

PC:	Dell Precision 340
Operating System:	Windows 2000
Data Card:	DASY4 Measurement Server
Serial Number:	1080

#### Data Converter

Features:	Signal Amplifier, multiplexer, A/D converted and control logic.
Software:	DASY4 Software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock.

#### PC Interface Card

Function:	24 bit (64 MHz) DSP for real time processing Link to DAE3 16 bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot.
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DASY4 SAR System Specifications (Continued)	
E-Field Probe	
Model:	ET3DV6
Serial No:	1528
Construction:	Triangular core
Frequency:	10 MHz to 2.55GHz
Linearity:	±0.2 dB (30 MHz to 2.55GHz)
Probe Length (mm):	337
Probe Diameter (mm):	10
Tip Length (mm):	10
Tip Diameter (mm):	6.8
Sensor X Offset (mm):	2.7
Sensor Y Offset (mm):	2.7
Sensor Z Offset (mm):	2.7
Phantom	
Phantom:	Eli Phantom
Shell Material:	Fibreglass
Thickness:	2.0 ±0.1 mm